

ELECTRONIC CONNECTOR UTILIZING EDGE BOARD TERMINAL SYSTEMS

FIELD OF THE INVENTION

[0001] This invention relates to releasably mating electrical connectors for establishing a circuit between a power and/or command signal source and a utilization device and more specifically to a connector assembly comprising releasably matable members adapted to incorporate a printed circuit board having edge connectors therewithin so as to provide intelligence in the circuit.

BACKGROUND OF THE INVENTION

[0002] It is becoming more common to use microprocessors, microcontrollers and the like in the electrical circuits found in automobiles to provide sophisticated control functions. One way to achieve this objective is disclosed in the co-pending application for U.S. patent Serial No. 10/055,563 for "Scalable, Modular Architecture For Automotive Power Distribution And Body Control Functions," filed January 23, 2002, and assigned to Yazaki North America, Inc. Another way is to use a so-called "smart connector"; i.e., a connector which incorporates a chip to provide intelligence in the connector itself. This approach has involved the use of lead frames which are complex and costly.

SUMMARY OF THE INVENTION

[0003] The present invention provides an electrical connector having releasably matable first and second connector components designed to incorporate therein a printed circuit board (PCB) having flush edge connectors and being capable of carrying intelligent components such as microprocessors, microcontrollers and the like. The connector assembly of the present invention provides structure to ensure that the PCB is properly oriented and fully inserted into the connector bodies. The assembly is particularly useful in automotive circuits, such as those found between a power source and, for example, a remote controlled mirror mounted on the automotive body. The invention, as will be apparent to those skilled in the art, is useful in applications other than the control of automotive utilization devices.

[0004] In general, the preferred embodiment of the invention comprises complementally releasably matable first and second connector bodies made of an injection molded plastic such as polyethylene. Each of the matable connectors is hollow and has laterally opposite guide channels to receive the opposite side edges of a small circuit board. Each of the connector bodies is molded to define a plurality of axially oriented and parallel channels receiving spring type electrical terminals which can be crimped onto the stripped ends of wires. The spring portion of the terminals is designed and oriented to engage flush edge contacts on a PCB mounted within the hollow interior volume defined by the connector bodies. Position assurance features are provided to ensure that the PCB is both properly oriented and fully inserted into the first connector body interior.

[0005] In the preferred form, the connector assembly is provided with latch means having first and second complementally interengaging portions on the exterior surfaces of the first and second connector components, respectively, to releasably latch the bodies together when telescopically engaged. In addition, the assembly comprises a first security feature which is applied to the first connector body after assembly to ensure that the PCB remains in the fully inserted position and does not move back toward the direction in which removal normally occurs. An additional security feature is preferably provided to work in combination with a PCB edge detent structure to lock the PCB in place.

[0006] Other applications of the present invention will become apparent to those skilled in the art when the following description of the best mode contemplated for practicing the invention is read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

[0007] The description herein makes reference to the accompanying drawing wherein like reference numerals refer to like parts throughout the several views, and wherein:

[0008] FIG. 1 is a perspective view of a connector device embodying the invention;

[0009] FIG. 2 is an exploded perspective view of the device of FIG. 1 from the bottom;

[0010] FIG. 3 is a sectional view of the device showing the crimped terminals and the security locking, detection and protection features;

[0011] FIG. 4 is a sectional view of the device in the assembled state;

[0012] FIG. 5 is a sectional plan view showing the PCB layout and a second security means; and

[0013] FIG. 6 is a view of the complementary open ends of the connector bodies with some interior features removed for simplicity.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0014] Referring now to the drawing, the connector assembly of the present invention is shown to comprise a molded plastic first connector 10, a molded plastic second connector 12 which slides into and latches to the first connector 10 and a printed circuit board 14 (PCB) having flush edge contacts 16 deposited or otherwise formed at the longitudinally opposite edges thereof to provide electrical circuits to intelligent components mounted on the PCB 14; examples include microprocessors, microcontrollers and components which are auxiliary thereto. Wires 20 bring power and ground and control or command signals into the second connector 12 and, through terminals to be described, to the PCB components as well. Wires 18 connect the power and ground and output control or command signals to a utilization device such as a remote control automotive mirror.

[0015] A latch feature 22 is integrally molded to the top surface of the first connector 10 and a complementary latch structure 24 is provided on the top surface of the second connector 12. Although the latches 22 and 24 may be of any number of different configurations, the present illustration provides an easily manipulated spring latch which permits the connectors 10 and 12 to be securely joined yet permits simple and easy release to separate the connectors 10 and 12 when desired. The latch feature 22 comprises a detent feature 26 integrally molded on the inside surface thereof and the complementary latch structure 24 comprises a spring arm 30 having a cam surface 28 which guides the detent 26 into a hole or aperture in the spring arm and holds it in place when the connectors 10 and 12 are coupled. A supplemental lock piece 27 shown in FIG. 2 may be inserted into the latches 22, 24 to prevent operation thereof. Acting as a connector position assurance device, the lock piece 27 detects

incompletely mated connectors. If the supplemental lock piece 27 is not in place, pushing the spring arm 30 downwardly permits the connectors 10 and 12 to be taken apart.

[0016] As best shown in FIGS. 1 and 6, the first connector 10 is preferably injection molded of a suitable plastic such as polyethylene into a doubly truncated cylindrical shape and is provided with longitudinally extending guide ribs 32 on laterally opposite interior surfaces to provide channels which receive and guide the PCB 14 into the interior volume of the first connector 10. The length of the connector 10 along its axis of symmetry is only slightly greater than that of the PCB 14 as shown in FIG. 4. As shown in FIG. 6, the second connector 12 has guide channels 35 formed therein to receive the PCB 14 when the second connector 12 is inserted into the connector 10.

[0017] To ensure that the PCB 14 is properly oriented when inserted into the interior volume of the first connector 10, a slot 37, as best shown in FIGS. 2 and 5, is formed off-center in the leading edge of the PCB. A longitudinally extending rib 34 on the interior of the first connector fits snugly into the slot 37 only if the PCB 14 is inserted in the proper orientation; i.e., if it is inverted end for end, the rib 34 will hit the edge of the PCB 14 and not allow it to be fully inserted. Similarly, if the PCB 14 is rotated 180° about its longitudinal axis, the off-set nature of the rib 34 in the slot 37 will be such that again the PCB 14 can not be fully inserted. Only if in the proper orientation can the PCB 14 be fully inserted into the first connector 10.

[0018] Once the PCB 14 is fully and properly inserted in the correct orientation, a first position assurance latch 36 can be inserted into an opening 39 in the bottom of the first connector 10 as best shown in FIG. 2. The position assurance latch member 36 fits immediately behind the trailing edge of the PCB 14 as shown in FIG. 5 and can only be fully inserted into the body of the connector 10 if the PCB 14 is fully inserted. The latch member 36 also prevents the PCB 14 from being backed out during use.

[0019] As shown in FIG. 5, internal ribs 38 are integrally molded into the connector body 10 to define a series of parallel channels which receive the wires 18 and also receive the crimped spring terminals 40 and 42 to engage the edge contacts

16 on the upper and lower surfaces adjacent the leading edge of the PCB 14 when it is inserted into the connector 10 in the proper orientation. This eliminates the need for lead frames in providing electrical connectivity between the power source and ground and the intelligent components on the PCB 14.

[0020] Additional wire guide ribs 44 are integrally molded into the interior of the second connector 12 as best shown in FIG. 1. These ribs 44 also provide insertion channels or guides for the wires 20 as well as means to provide for the insertion of additional crimped wire end terminals 46. The terminals 46, like the terminals 40 and 42, have spring end portions to engage the edge contacts 16 on the lower surface adjacent the trailing edge of the PCB 14 as best shown in FIG. 3.

[0021] Additional position assurance for the proper insertion of the PCB is provided by interior bars 48 on the inside laterally opposite surfaces of the first connector 10 in registry with the PCB guide slot provided by ribs 32 and working in combination with detent notches 49 formed in the laterally opposite edges of the PCB 14 adjacent the lead edge thereof. The bars 48 and the small detent notches 49 receive and hold the PCB 14 in the fully inserted position. Thereafter, a C-shaped molded plastic security latch 50 is inserted into the open end of the first connector with arms which project into and behind the resilient detent arms 48 so as to prevent the detent arms from flexing outwardly. This essentially locks the PCB 14 in place. Alternatively, the interior bars 48 could be designed to be more difficult to separate from the detent notches 49, such that the bars themselves act as a more permanent lock without the help of security latch 50. The latch 50 could then be used simply as a PCB position assurance device.

[0022] Cover 52 is used to protect the contact surfaces of terminals 46. Additional latch 54 is provided to secure the crimped spring terminals of the second connector 12 in place as shown in FIG. 2. All of the latches are shaped and sized to slide into guideways providing some friction and may have detents to provide snap-fits as desired.

[0023] In use, the wires 18 and 20 are attached to the terminals 40, 42 and 46 by crimping and the terminals are assembled into their respective connector bodies 10 and 12. The PCB is loaded into the body 10 in the proper orientation. The latch 36 is

driven into place to prevent the PCB from being removed from the connector 10. Cover 52 and latch 54 are assembled on the connector 12 after the terminals are installed. It will only be possible to fully insert the latch if the PCB is in the correct orientation and is all the way in. The connector 12 is then inserted into the connector 10. The components 60 on the PCB 14 are now ready to be energized by the power supply wires 20 and activate and control a device via output wires 18.

[0024] While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiments but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims, which scope is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures as is permitted under the law.